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ANAHEIM CONVENTION CENTER & ANAHEIM MARRIOTT
ANAHEIM, CALIFORNIA, USA
#TMSAnnualMeeting

SUBMIT AN ABSTRACT FOR THE FOLLOWING TMS2022 SYMPOSIUM:

ADDITIVE TECHNOLOGIES

Additive Manufacturing of Refractory Metallic Materials

As metal Additive Manufacturing (AM) technology evolves as a technically and economically viable option for component production, technology boundaries are being expanded towards more challenging materials, like refractory metallic materials, both alloys and pure metals. As manufacturing involving refractory alloys has been a persistent challenge, the use of AM for the production of complex parts presents a potentially economically viable alternative. For some key applications, AM seems to be one of the few options available. As a result, the exploration and development of metal AM of alloys based on W, Mo, and Nb, among others, has attracted many researchers and organizations. This symposium lets them share their work, achievements, and challenges while enabling researchers and engineers in private and government organizations to understand the state of the art, current limitations, and a path forward.

The growing interest and research activity on AM for refractory alloys has been driven in part by the growing interest in high-performance turbine engines, hypersonic technology for defense and commercial applications, space power generation, and nuclear propulsion for long-range space exploration. However, many other applications involve these materials, like the production of superconductive resonance cavities for particle accelerators and even quantum computing. Refractory metals present unique inherent challenges like elevated reactivity, low ductility, and high melting temperatures. As a result, the printing of these materials has shown to be quite challenging. Developments have been proposed using preheating to elevated temperatures to minimize cracking while printing refractory alloys, which further enhances oxidation. Other approaches like alloy re-designing and smart thermal engineering during printing could be solutions. Some of the cracking phenomena associated with printing are still unclear and therefore robust solutions have been elusive. Finally, the final obtained microstructures from AM are unique in several aspects and their influence on performance has been a matter of study.

This symposium brings together the AM community engaged in the fundamental and applied aspects associated with refractory metals printing from industry, government agencies, national laboratories, and universities. Topics will include:

- Cracking phenomena associated with solidification and solid-state low ductility on refractory alloy systems during AM
- Alloy elements and impurities effect on refractory alloys printability
- Alloy design for improved printability and performance of refractory alloys
- The use of conventional and advanced phase transformation models on the design and optimization of refractory alloys better suited for different AM processes
- Relationships between solidification structure, impurities segregation, solid-state crystallographic structure, and defect formation during additive manufacturing and the use of fundamental understanding to propose engineering solutions
- Modeling and simulation of the printing process and phase transformations associated with AM refractory alloys
- Specific applications or development for key components

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